

REMARKS

The Official Action dated March 11, 2003 has been carefully considered.

Accordingly, the changes presented herewith, taken with the following remarks, are believed sufficient to place the present application in condition for allowance. Reconsideration is respectfully requested.

By the present Amendment, claims 1 and 15 have been amended to further define the conjugated diene in accordance with the teachings of the specification, particularly at page 11, line 20 - page 12, line 21, and the examples. Claim 22 is amended to correct a typographical error. Claims 8-12 and 23-25 have been cancelled, and claims 26-33 are newly presented herein. Claims 26-30 contain limitations from previous claims 8-12, respectively, while claims 31-33 contain limitations from previous claims 9, 10 and 13, respectively. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, claims 8-12 and 23-25 were rejected under 35 U.S.C. §103(a) as being unpatentable over JP 4-189810 A (JP '810) in view of the Mine et al U.S. Patent No. 5,856,562. This rejection is traversed. However, to expedite prosecution, claims 8-12 and 23-25 directed to polymerization inhibitors have been cancelled and the pending claims are directed to polymerization-inhibiting compositions (claims 1-6) and methods for inhibiting polymerization (claims 15-20, 22 and 26-33). It is therefore submitted that the rejection of claims 8-12 and 23-25 under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

Claims 1-6, 15-20 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over JP '810 in view of Mine et al and further in view of the Albert et al U.S. Patent No. 3,371,124. The Examiner asserted that JP '810 teaches polymerization inhibitors for (meth)acrylate compositions consisting of molecular oxygen-containing gases and at least

one compound selected from the group (A) including N,N-diethylhydroxylamine, and group (B) including phosphoric acid and derivatives thereof. The Examiner asserted that Albert et al teach inhibition of undesirable polymerization of olefinic monomers which give rise to popcorn polymers by use of a mixture of N,N-alkylhydroxylamine and its bisoxalate salt, particularly for the preparation of synthetic rubber. The Examiner relied on Mine et al as disclosing a N-oxyl compound as an inhibitor for polymerization of ethylenically unsaturated monomers. The Examiner asserted that Albert et al provide the motivation to use the polymerization inhibitors of JP '810 and Mine et al with a conjugated diolefin, apparently since both have ethylenically unsaturated monomers.

However, Applicants submit that the polymerization-inhibiting compositions of claims 1-6 and the methods for inhibiting polymerization of claims 15-20, 22 and 26-33 are nonobvious over and patentably distinguishable from the combination of JP '810, Mine et al and Albert et al. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

More particularly, as defined by claim 1, the polymerization-inhibiting compositions according to the invention comprise at least one compound (a) selected from the group consisting of a compound having an NO radical in its molecule and a precursor compound capable of forming an NO radical, a phosphorous-containing compound (b), and a conjugated diene-containing hydrocarbon mixture selected from the group consisting of an isoprene-containing C₅ hydrocarbon fraction and a 1,3-butadiene-containing C₄ hydrocarbon fraction. The various hydrocarbons typically contained in such fractions are described at page 12 of the present application. The weight ratio of the compound (a) to the phosphorous-containing compound (b) is 1:10 to 100:1.

According to claim 15, the methods for inhibiting polymerization according to the invention comprise causing at least one compound (a) as defined in claim 1 and a

phosphorous-containing compound (b) to coexist at a weight ratio of the compound (a) to the phosphorous-containing compound (b) of 1:10 to 100:1, with a conjugated diene-containing hydrocarbon mixture as also defined in claim 1.

On the other hand, JP '810 is directed to (meth)acrylate compositions having good flexibility and reduced smell (fumes) and skin-irritation useful for paint. The (meth)acrylate compositions are prepared by epoxidizing (meth)acrylate compositions with oxidants in the presence of polymerization inhibitors consisting of molecular oxygen-containing gases and at least one compound selected from each of two specified groups. The first group includes, among others, N,N-diethylhydroxylamine while the second group includes phosphoric acid and additional phosphorous-based acids and salts.

However, Applicants find no teaching or suggestion by JP '810 of a polymerization-inhibiting composition as recited in claim 1 and containing a conjugated diene-containing hydrocarbon mixture, particularly wherein the mixture is selected from the group consisting of an isoprene-containing C₅ hydrocarbon fraction and a 1,3-butadiene-containing C₄ hydrocarbon fraction. Similarly, Applicants find no teaching or suggestion by JP '810 relating to a method for inhibiting polymerization of such a conjugated diene-containing hydrocarbon mixture as recited in claim 15. In fact, Applicants find no teaching or suggestion by JP '810 of polymerization inhibition for such conjugated diene-containing hydrocarbon mixtures. To the contrary, JP '810, as noted above, is directed to (meth)acrylate compositions and polymerization inhibitors for (meth)acrylate compositions prepared by epoxidizing with oxidants.

Mines et al and Albert et al do not resolve the deficiencies of JP '810. For example, Mine et al disclose a method for inhibiting polymerization of (meth)acrylic acid or esters thereof using a polymerization inhibitor containing a N-oxyl compound in combination with phosphine compound or a cobalt compound. As in JP '810, Applicants find no teaching by

Mine et al relating to a polymerization-inhibiting composition including a conjugated diene-containing hydrocarbon mixture as required by claim 1, relating to a method for inhibiting polymerization in a conjugated diene-containing hydrocarbon mixture as recited in claim 15, or relating to any polymerization inhibition of a conjugated diene. Thus, Mine et al do not resolve the deficiencies of JP '810.

Finally, Albert et al disclose inhibition of polymerization of olefinic monomers which give rise to popcorn polymers by the use of a mixture of N,N-dialkylhydroxylamine and its bis-oxalate salt as a popcorn polymer inhibitor in processes relating to the preparation of synthetic rubber. However, Applicants find no teaching or suggestion by Albert et al relating to polymerization-inhibiting compositions or methods for inhibiting polymerization which employ the combination of at least one compound (a) selected from the group consisting of a compound having an NO radical in its molecule and a precursor compound capable of forming an NO radical and a phosphorous-containing compound (b) as required by claims 1 and 15. Thus, Albert et al similarly fail to resolve the deficiencies of JP '810.

The Examiner appears to base the combination of Albert et al with JP '810 and Mine et al on the basis that the (meth)acrylate polymerizations of JP '810 and Mine et al employ an ethylenically unsaturated compound, as does the synthetic rubber preparation of Albert et al, disregarding the fact that neither JP '810 nor Mine et al provide any suggestion relating to a conjugated diene polymerization, nor does Albert et al provide any teaching or suggestion relating to (meth)acrylate polymerization or epoxidation. Not only does is such a combination not suggested or motivated by the cited prior art, it would not be apparent to one of ordinary skill in the art in view of the significant difference in polymerization mechanisms between (meth)acrylates as taught by JP '810 and Mine et al and conjugated dienes. That is, the polymerization which is prevented in Mine et al and JP '810 is based on a (meth)acrylate that is common to a conjugated diene in terms of containing an ethylenically unsaturated

bond, but, significantly, differs from it in that the former is a monoolefin while the latter is a diolefin. The monoolefin (meth)acrylate has a single polymerization mechanism whereas the conjugated diene, for instance, butadiene, has two polymerization mechanisms, for example, 1,2-addition, and 1,4-addition. It would not have been easily foreseen, even by those skilled in the art, that the polymerization inhibitors set forth in Mine et al and JP '810 would be effective for prevention of polymerization of a conjugated diene in Albert or, more specifically, for prevention of polymerization of the C₄ hydrocarbon fraction or C₅ hydrocarbon fraction containing a conjugated diene of claims 1 and 15, that is polymerized via a polymerization mechanism quite different from that of a (meth)acrylate.

Typically, a C₄ hydrocarbon fraction or C₅ hydro-carbon fraction comprises 20 to 40% of a conjugated diene and 30 to 40% of a hydrocarbon having one unsaturated hydrocarbon, with the balance being a saturated hydrocarbon, and contains little or no monomer containing a polar group such as a (meth)acrylate. On the other hand, a polar group generally has an electron withdrawing or donating action, exerting some significant influences on polymerization reaction characteristics. Mine et al and JP '810 teach polymerization inhibitors that are effective against polar group-containing monomers, and so it would not have been obvious that those polymerization inhibitors would be effective for prevention of polymerization of a C₄ hydrocarbon fraction or C₅ hydrocarbon fraction that contains little or no such polar group.

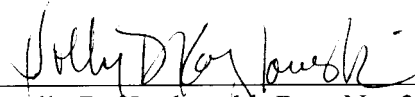
The mere fact that prior art could be modified to result in a claimed invention would not have made the modification obvious unless the prior art suggested the desirability of the modification, *In re Mills*, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). The cited prior art does not suggest the modifications necessary to arrive at the presently claimed compositions and methods, nor does the prior art provide any reason or motivation to make such a

modification. Thus, the combination of JP '810, Mine et al and Albert et al does not render the presently claimed compositions and methods obvious.

It is therefore submitted that the compositions defined by claims 1-6 and the methods defined by claims 15-20, 22 and 26-33 are nonobvious over and patentably distinguishable from the cited combination of references, whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the rejections under 35 U.S.C. §103, and places the present application in condition for allowance. Reconsideration and an early allowance are requested.

Respectfully submitted,



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